Supporting information for

High-sensitivity and field analysis of lead by portable optical emission spectrometry using microplasma trap

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1. Picture of HG-*in situ* DBD trap-OES

Fig. S1 Picture of HG-in situ DBD trap-OES.

2. The operational parameters of ICP-MS

Table S-1 Operational parameters of ICP-MS

Parameters	Values
Incident RF power	1150 W
Sampling depth	120 mm
Nebulizer Ar gas flow rate	0.8 L min^{-1}
Cooling Ar gas flow rate	14 L min^{-1}
Auxiliary Ar gas flow rate	1.2 L min^{-1}
Peristaltic pump rate	30 rpm
Dwell time	10 ms
Isotopes	^{208}Pb
Internal standard isotopes	^{175}Lu

3. Background correction method

In this paper, an iteratively modified moving average algorithm is employed to eliminate the influence of background fluctuation. In this method, a baseline is fitted according to Equation (1), in which fBase(i) indicates the intensity of point i on baseline curve, f(i) indicates the intensity of point i on initial spectrum and dAver(i) indicates the average intensity of point i and its surrounding points on initial spectrum, which is calculated as Equation (2). In Equation (2), d indicates the number of point on one side on point i (in this experiment, d is set as 13). After the baseline curve (fBase) is obtained, another baseline (fbase2) is calculated by replacing f(i) in Equation (1) and Equation (2) with fbase(i). The final baseline curve is obtained by iterate n times like this (in this experiment, n is set as 8). The spectrum after background correction is obtained by subtracting the final baseline curve from the initial spectrum.

$$fBase(i) = \begin{cases} f(i) & f(i) < dAver(i) \\ dAver(i) & f(i) > dAver(i) \end{cases} \quad (1)$$

$$dAver(i) = \left(\sum_{j=-d}^{j=d} f(i+j)\right)/(2*d+1) \quad (2)$$

4. Peak volume, linear range, precision and sensitivity

In this article, a peak volume algorithm is used for the OES quantification of Pb. Regarding OES, peak height and area have been usually utilized to calculate the signals for quantitative analysis. Herein, for HG-*in situ* DBD trap OES, the complete release of Pb occupies a certain amount of time by means of the intensity-wavelength spectrum. So, Pb signals can be calculated by combination of intensity, wavelength and time, which become a group of 3-dimensional data, namely peak volume. The calculation equations of peak volume are described as Equation 1 and Equation 2. The effects of these calculation methods including peak height, area, and volume on linear range and sensitivity were evaluated and results were summarized in Table S1. As can be seen, the peak volume have a great effect on improving the sensitivity and precision of Pb.

$$I_{area}(t) = \sum_{\lambda=\lambda_{start}}^{\lambda=\lambda_{end}} I_t(\lambda) \quad (1)$$

$$I_{volume} = \sum_{t=t_{start}}^{t=t_{end}} I_{area}(t) \quad (2)$$

In Eq. (1), $I_{area}(t)$ is the intensity calculated by peak area of the intensity-wavelength spectrum collected at t time. $I_t(\lambda)$ refers to the intensity-wavelength spectrum collected at t time. λ_{start} and λ_{end} refer to the wavelength of starting point and ending point of the peak. In Eq. (2), I_{volume} is the intensity calculated by peak volume. t_{start} and t_{end} refer to the time index of starting intensity-wavelength spectrum and ending intensity-wavelength spectrum.

It is worth mentioning that the background correction was performed for each intensity-wavelength spectrum to reduce errors caused by baseline fluctuation before the comparison.

Table S1 Linear range and sensitivity achieved by different signal calculation methods.

Calculated method	Sensitivity (L μg^{-1})	Linear range (μg L^{-1})	RSD (%)

Peak height	48	1-100	4
Peak area	595	1-100	3.5
Peak volume	3775	1-100	1.4

5. Optimization of trap conditions

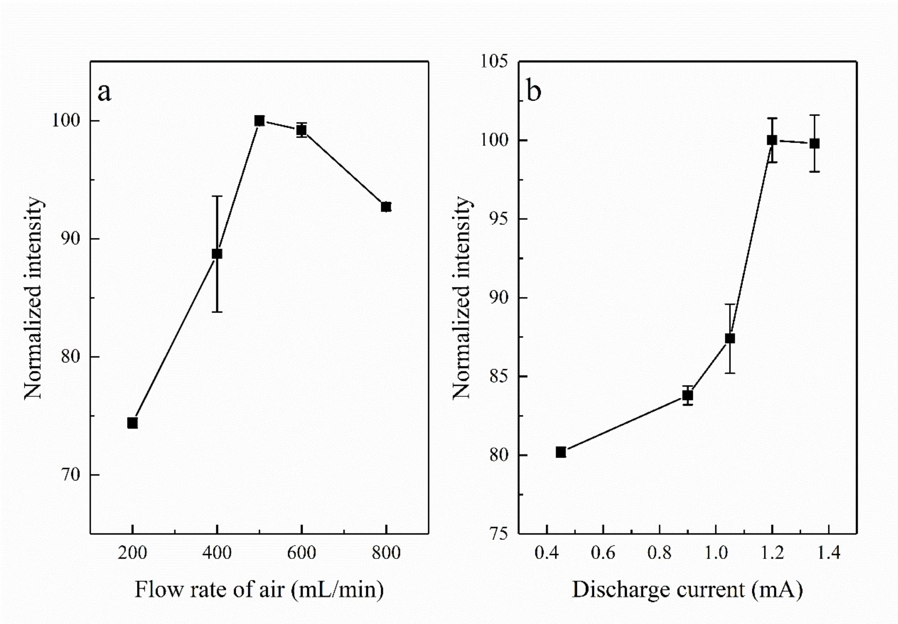

Fig.S2 Dependence of DBD trapping on air flow rate and discharge current. In Fig. S1a, intensities are normalized with the Pb signal at 500 mL/min set at 100 for. In Fig. S1b, intensities are normalized with the Pb signal at 1.2 mA set at 100.

6. Optimization of sweeping conditions

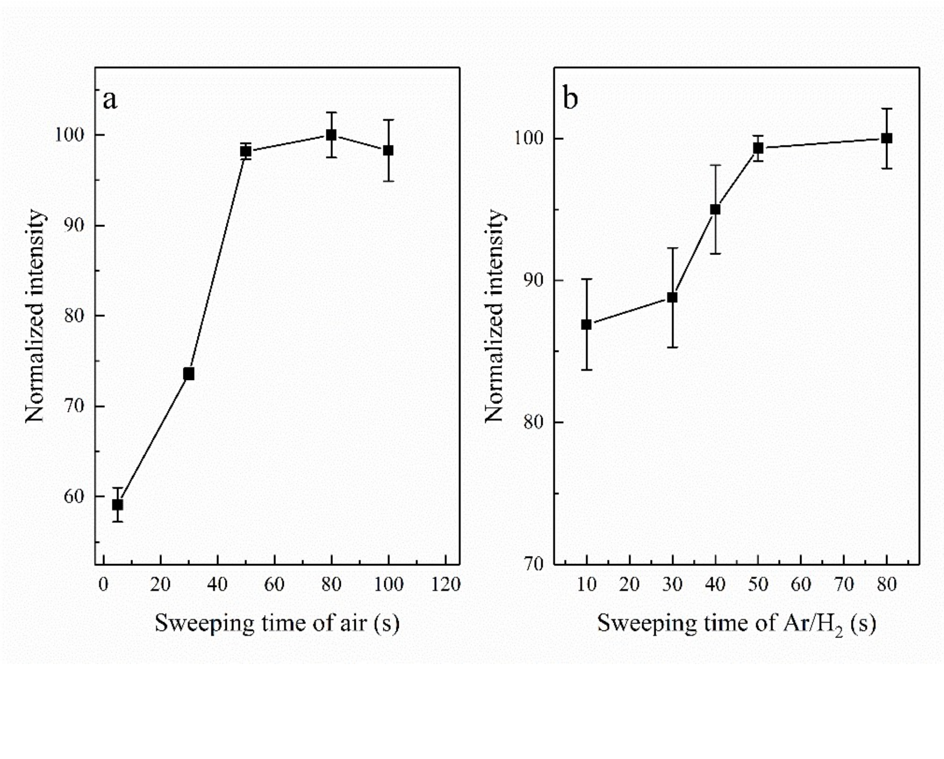

Fig. S3 Effect of air and Ar/H_2 sweeping duration on moisture interference. Fig. S2a shows the effect of air sweeping duration on Pb intensities without subsequent Ar/H_2 sweeping. The intensities are normalized with the Pb intensity at 80 s set at 100. Fig. S2b shows the effect of Ar/H_2 sweeping on Pb intensities after 50 s air sweeping. The intensities are normalized with the Pb intensity at 80 s set at 100.

7. Optimization of releasing condition

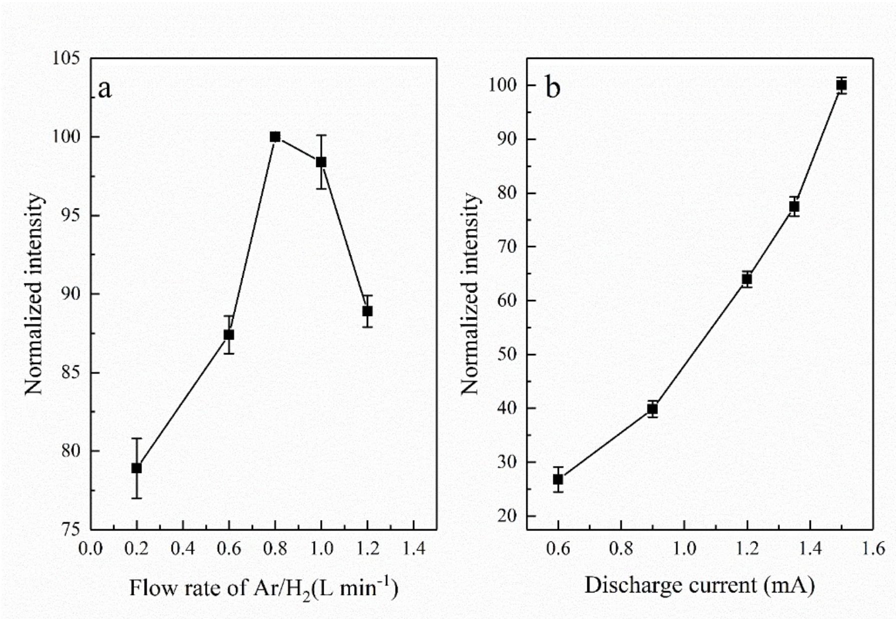

Fig. S4 The effect of Ar/H_2 flow rate and discharge current on Pb intensities for DBD release. In Fig.S3a, the Pb intensity at 800 mL/min is set as 100, and the others are normalized. In Fig.S3b, the Pb intensity at 1.5 mA is set as 100, and the others are normalized to this value.

8. Standard curve of Pb

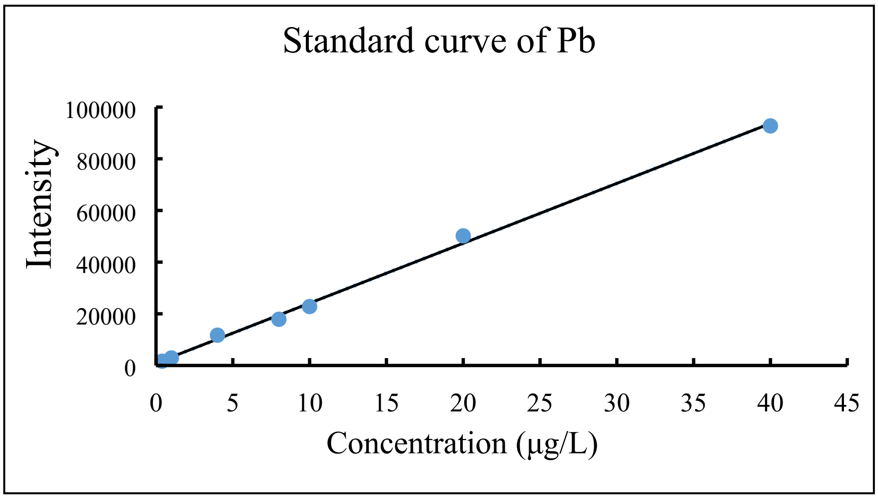

Fig.S5 Standard curve of Pb.